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Proposing Regression Models to Estimate Uniaxial Compressive Strength and Elastic Modulus of the Sandstones Based on Physical Properties and Compressional Wave Velocity

Many engineering structures have been built on the sandstones. The main purpose of this study is to estimate the uniaxial compressive strength (UCS) and modulus of elasticity (Es) of sandstones using regression models. For this purpose, petrographic studies, compressional wave velocity (Vp), porosity, density and uniaxial compressive strength tests were performed on dry and saturated samples of sandstones prepared from Mosha village in the northwest of Damavand city. The studied sandstones were classified as feldspathic litharenite and litharenite. Due to the effect of moisture on the physical and mechanical properties of these sandstones, the density and Vp of the samples in the saturated state compared to the dry state have increased by 4 and 20%, respectively. In contrast, UCS and Es have increased by 18% and 25%, respectively. The results of simple regression showed that the most accurate relationship (the highest correlation coefficient and the lowest error) of porosity, Vp and density with UCS and Es are logarithmic, linear and quadratic polynomials, respectively. Based on the determination coefficient (R^2=0.5-0.77) and the errors (RMSE=10.29-18.26; MAPE=1.70-2.80), the relationships presented by simple regression method for estimating UCS and Es showed high accuracy. The Vp and porosity also have the greatest impact on UCS and Es. Evaluation of empirical relationships of other researchers showed that some of these relationships have a determination coefficient of more than 50%. Examination of residual variance homogeneity graphs at the predicted value levels, determination coefficient and error of the methods showed that multivariate regression (R^2=0.73-0.74, RMSE=13.36-13.56, MAPE=1.06-1.22, Durbin-Watson= 1.56-1.70) has a high accuracy for estimating UCS and Es as compared to the simple regression

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